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W.P. No. 21-79-16

CONT. No. 85-41

W. O. No.

STR. SITE No. 24-145-487

HWY. No. 410

LOCATION Glidden Rd. Overpass

No of PAGES - 2

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 85 - 41

Ontario
Ministry of
Transportation and
Communications

INDEX

Note: For the purposes of this Contract, this report supersedes all other foundation investigation reports prepared by or for the Ministry in connection with the above-noted project.

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1,%	VOID RATIO
n	1,%	POROSITY
w	1,%	WATER CONTENT
S_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_p	%	PLASTIC LIMIT
w_S	%	SHRINKAGE LIMIT
I_p	%	PLASTICITY INDEX = $w_L - w_p$
I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	1,%	VOID RATIO IN LOOSEST STATE

e_{min}	1,%	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE

FOUNDATION INVESTIGATION REPORT

For

Glidden Road Overpass

W.P. 21-79-16; Site 24-145-487

Hwy. #410, District 6, Toronto

INTRODUCTION:

This report summarizes the factual information obtained from a foundation investigation carried out at the above mentioned site between 84-01-10 and 84-01-20. The fieldwork consisted of 21 sampled boreholes advanced by means of solid stem augers. In addition, bedrock was proven in 11 boreholes by obtaining up to 3.0 m of BXL rock core. The boreholes ranged in depth from 2.3 to 9.5 m below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located at the proposed Hwy. 410 - Glidden Road Overpass, immediately east of Heart Lake Road in the Town of Brampton, Regional Municipality of Peel.

Land use in the vicinity of the site is predominantly industrial. Topography across the site is generally flat with the ground surface sloping gently towards Lake Ontario in the south.

The site is located in the physiographic region known as the "Peel Plain". The characteristic deposit in the area under investigation is composed of cohesive glacial till whose thickness varies from 1.9 m to 4.3 m. The overburden is underlain by shale bedrock of the Meaford-Dundas formation, Ordovician Period.

This physiographic region is well drained by Credit, Oakville, and Etobicoke Creeks, which have cut deep valleys in the overburden. There is no extensive undrained depressions, swamps or bogs although in many of the interstream areas drainage is still imperfect.

SUBSURFACE CONDITIONS

General

The predominant soil deposit at this site is a glacial till composed of a heterogeneous mixture of silty clay, trace to some sand, gravel. This cohesive deposit varies in thickness from 1.9 to 4.3 m.

Fill material was encountered at an isolated area overlying the native till towards the south end of the site. The fill is over 2 m in depth and is composed of a cohesive silty clay, some sand, trace to with gravel, trace organics.

Underlying the overburden is grey shale bedrock which is highly weathered to weathered in the upper zone.

The boundaries between the subsoil types, insitu and laboratory test results, as well as groundwater levels are shown in the Record of Borehole Sheets in the Appendix. The location and ground elevation of each borehole are shown on Dwg. No. 3. Three estimated stratigraphical sections based on the borehole data are shown on Dwg. No. 3A.

The description of the glacial till, fill, and shale bedrock is given as follows:

Glacial Till

This is the principal deposit in the area and is found to vary in thickness from 1.9 m to 4.3 m. The till is covered with 60 mm of topsoil.

The results of Atterberg Limits testing carried out on samples from this cohesive deposit are plotted on Fig. 1 indicating that the matrix of this glacial till is a silty clay of low plasticity (CL zone) with a localized area (BH 3) of silty clay of medium plasticity (CI zone).

The result of grain size distribution tests conducted on 20 samples from this stratum indicate there is a reasonably uniform silt content with a considerable variance in the clay, sand, and gravel contents. The results of these tests are plotted in envelope form on Fig. 2, and are summarized as follows:

Gravel	2 - 23%
Sand	4 - 20%
Silt	43 - 56% (one sample 38%)
Clay	15 - 33%

As a result of the grain size distribution of this cohesive stratum, the glacial till is described as a heterogeneous mixture of silty clay, trace to some sand; gravel.

The consistency of this deposit is assessed as ranging from Firm to Hard based on Standard Penetration Test 'N' values of 5 blows/300 mm to 100 blows/30mm.

Fill

This material was encountered in BH 19 and BH 20 and is over 2 m in thickness, and was not investigated for its full lateral extent.

The results of Atterberg Limits testing carried out on samples from this cohesive material are plotted on Fig.3 indicating that the fill matrix is of low to medium plasticity.

The results of grain size tests conducted on 4 samples from the fill indicate the following distribution:

Gravel	1 - 39%
Sand	10 - 16%
Silt	38 - 59%
Clay	10 - 32%

Testing for organic content indicated 3.6%-5.4% organics in the fill.

As a result of this data, this cohesive fill is described as silty clay, some sand, trace to with gravel, trace organics.

The consistency of the fill is considered as being very soft to very stiff based on Standard Penetration Test 'N' values of 2 to 15 blows/300 mm.

Bedrock

Bedrock at the site was proven in 11 of the 21 sampled boreholes by obtaining BXL size rock cores. In the other 10 boreholes, split-spoon samples of the weathered shale zone were taken and augering was advanced to refusal.

Bedrock was encountered below the glacial till at a depth varying from 1.9 m to 4.4 m below ground surface. The elevation of the bedrock surface varies from 199.4 at the north end of the site to 195.0 at the south end. This corresponds to an approximate dip angle of 1° in the south direction.

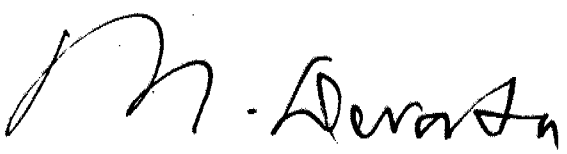
Bedrock at the site consists of grey shale of the Meaford-Dundas formation. The thickness of the weathered zone varies from 0.3 m to 5.4 m. Standard Penetration Test 'N' values obtained from the upper shale zone range from 58 blows/300 mm to 100 blows/30 mm.

The bedrock formation includes randomly interbedded limestone seams generally from 10 - 100 mm in thickness.

Groundwater Conditions

The groundwater level was established at the time of the investigation by measuring in the open boreholes. The measurements indicate that the groundwater level varies from elevation 197.5 to 200.5. However, due to the impermeable nature of the till, the lowest water levels may not reflect a true stabilized condition. It therefore appears that the groundwater level varies from elevation 200.5 at the north end of the site to elevation 198.5 at the south end, implying a less than 1% gradient south towards Lake Ontario.

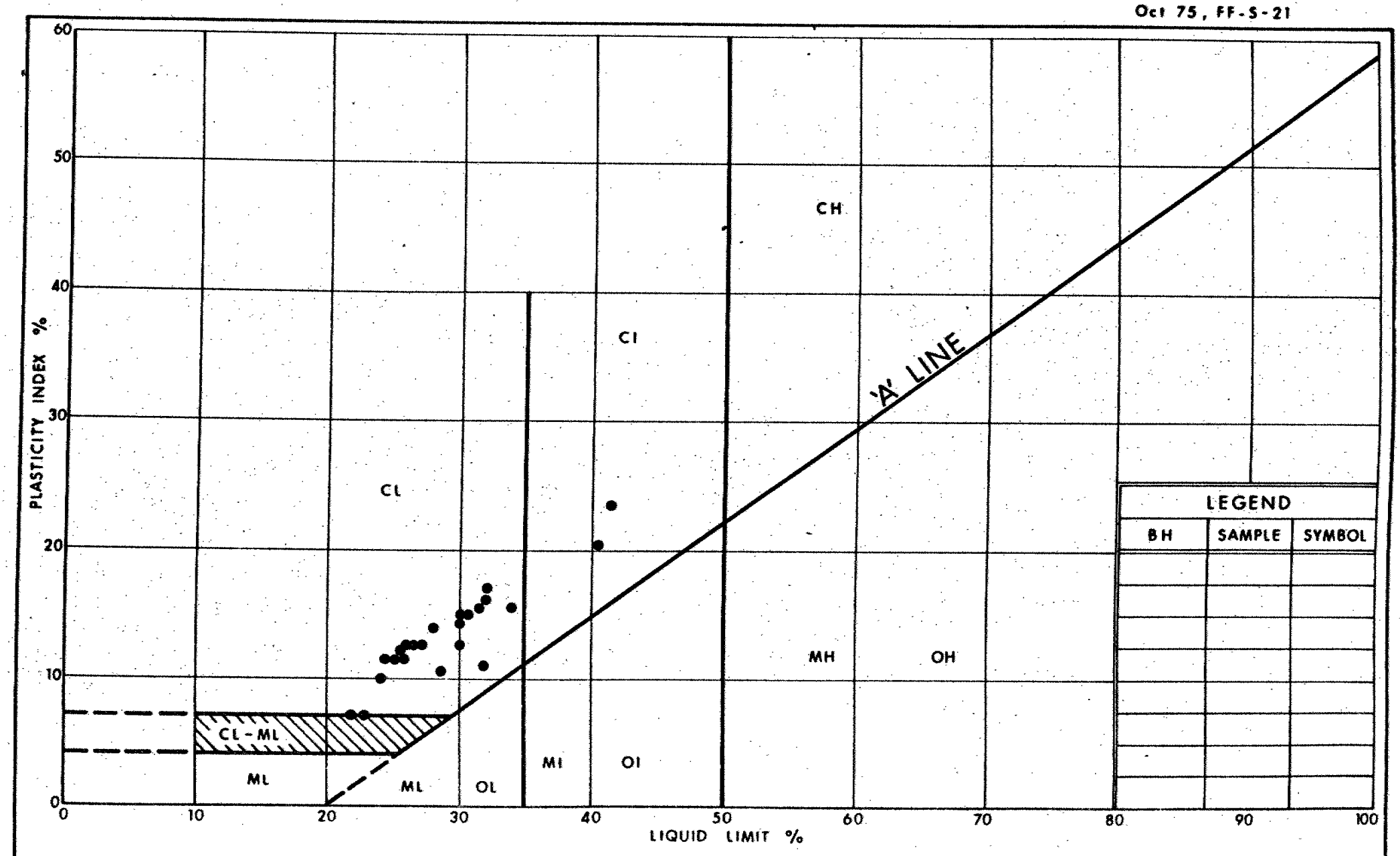
L. R. Politano
Project Foundations Engineer



M. Devata, P. Eng.
Chief Foundations Engineer (East)

May, 1985

APPENDIX



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PLASTICITY CHART

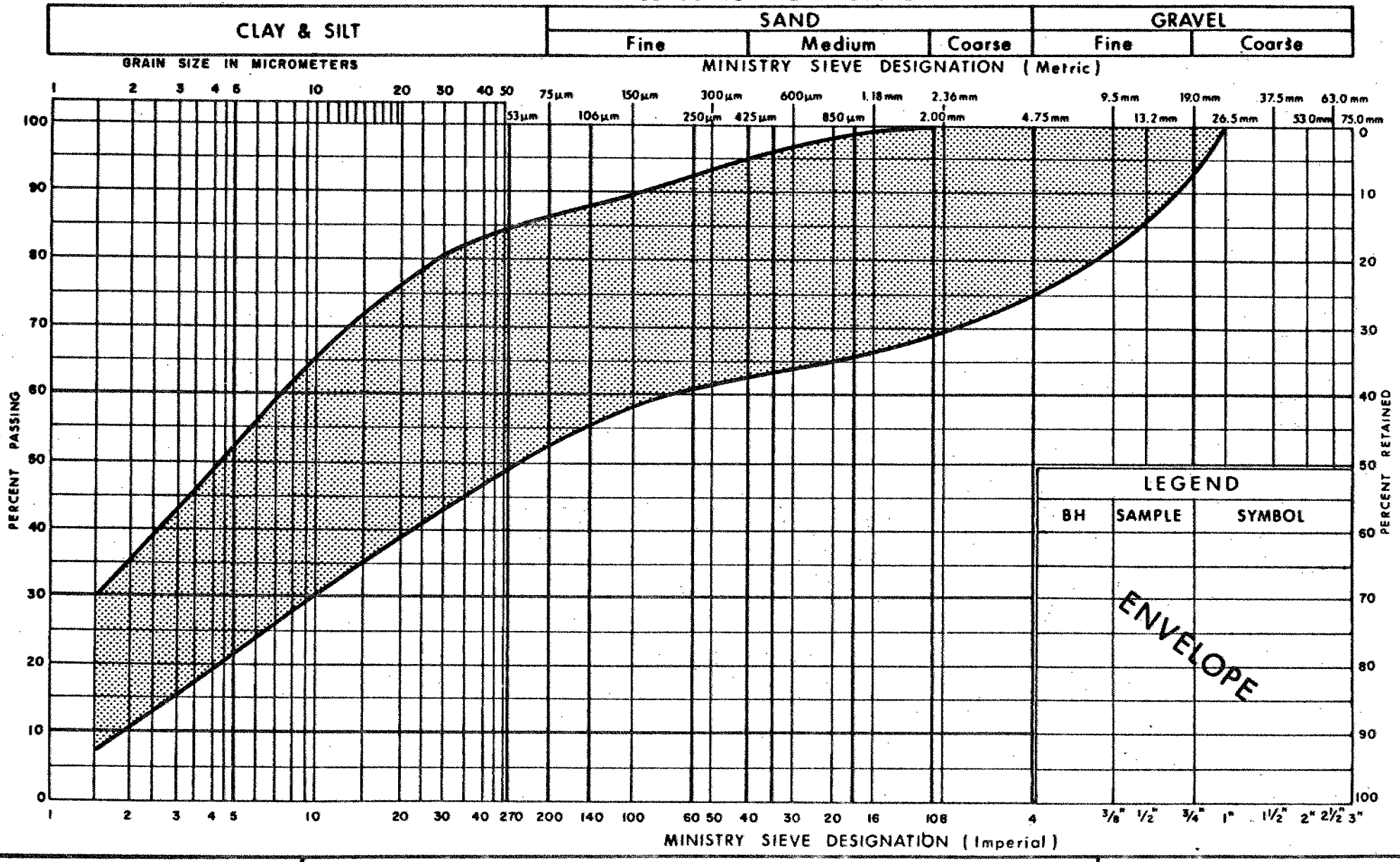
HET MIXTURE OF SILTY CLAY, TRACE TO SOME SAND, GRAVEL (Glacial Till)

FIG No 1

W P 21-79-16

∞

UNIFIED SOIL CLASSIFICATION SYSTEM



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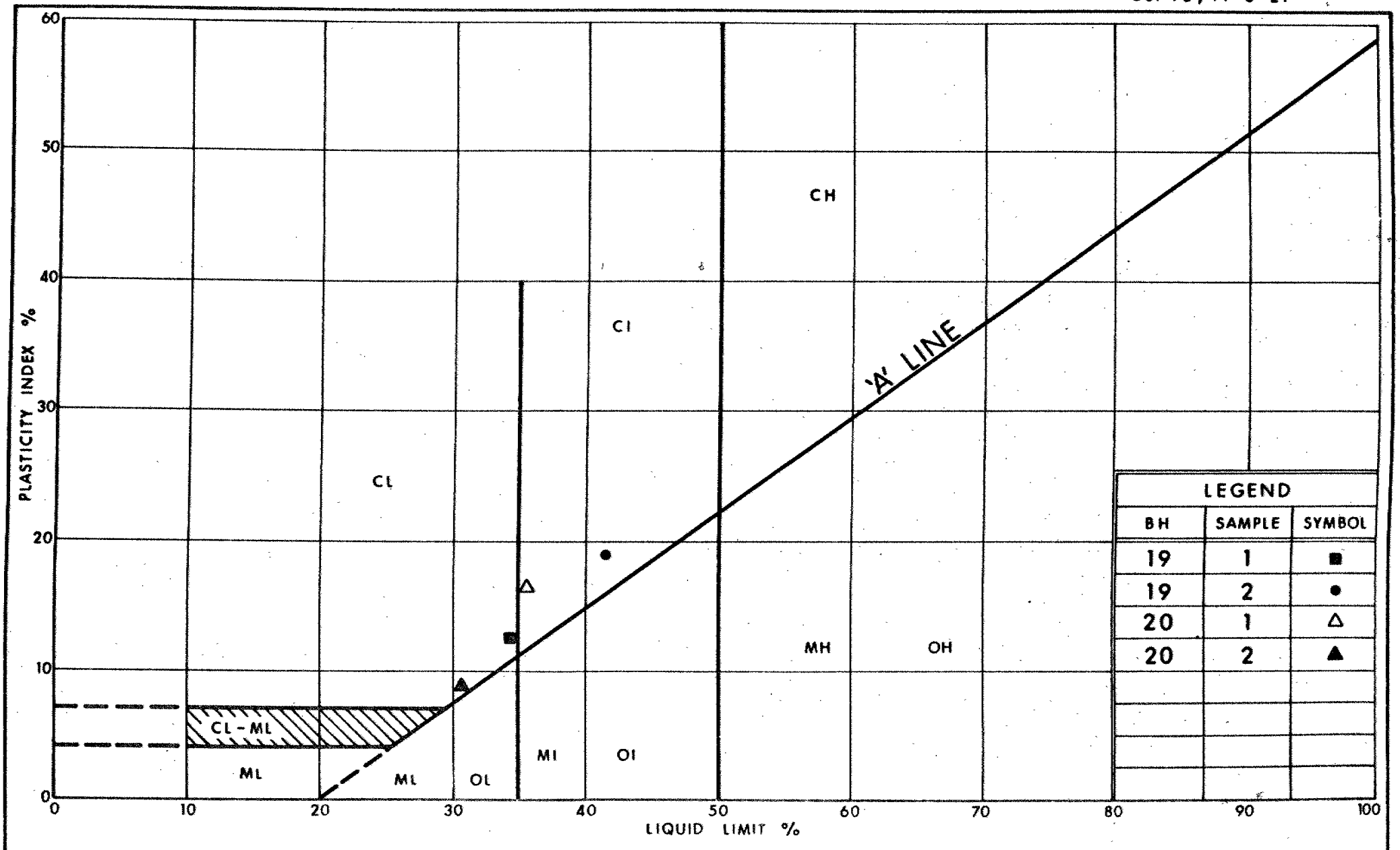
GRAIN SIZE DISTRIBUTION

HET MIXTURE OF SILTY CLAY, TRACE TO SOME SAND, GRAVEL
(Glacial Till)

FIG No 2

W P 21-79-16

6



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PLASTICITY CHART
SILTY CLAY (FILL)
SOME SAND TRACE TO WITH GRAVEL, TRACE ORGANICS

FIG No 3
W P 21-79-16

10

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Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 855.8; E 287 163.8 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-10 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.8	Ground Surface										
0.0	Heterogeneous mixture Silty Clay Trace to some sand, gravel (Glacial Till)		1	SS	22		201		o		2 28 45 25
199.4	V. stiff						200				
2.4	Grey Shale Bedrock		2	SS	148		199				
			3	SS	120/15cm						
	Highly weathered Limestone layer interbedded with shale seams		4	SS	139/15cm		198				
			5	BXL RC	70% REC		197				RQD = 33%
	Shale with randomly interbedded limestone seams 5-20 mm thick		6	BXL RC	94% REC		196				RQD = 67%
195.2	Unweathered										
6.6	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

15 20/10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 2

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 846.0; E 287 153.7 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-10, 11 CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH o UNCONFINED • FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
201.7	Ground Surface										
0.0	Heterogeneous mixture Silty Clay Trace to some sand, gravel (Glacial Till)		1	SS	17		201		o		12 22 43 23
			2	SS	38	▼	200				
			3	SS	60		199				9 12 55 24
198.8	V. stiff to hard									-	
2.9	Grey Shale Bedrock		4	SS	58						
	Highly weathered		5	SS	62/5cm		198				
197.0											
4.7	End of Borehole Refusal to auger										

+3, ×5 : Numbers refer to Sensitivity

15 ◇ 5 (%) STRAIN AT FAILURE (20 / 10)

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 828.0; E 287 135.5 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-11, 12 CHECKED BY GF.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.5	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	7		201				12 19 43 26
			2	SS	21		200				
			3	SS	71		199				18 6 51 25
198.6	Firm to Hard										
2.9	Grey Shale Bedrock		4	SS	60/10cm		198				
	Highly Weathered		5	SS	100/15cm						
	Limestone layer interbedded with shale seams		6	BXL RC	100% REC		197				RQD = 46%
	Shale with randomly interbedded limestone seams 10-75 mm thick. Highly Weathered		7	BXL RC	62% REC		196				RQD = 13%
							195				
			8	BXL RC	100% REC						RQD = 63%
193.5	Unweathered						194				
8.0	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No. 4

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 817.8; E 287 125.0 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-11 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
201.6	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, Trace to Some Sand, Gravel (Glacial Till)		1	SS	21	▼	201		W		7 23 50 20
			2	SS	5		200				
			3	SS	5		199				
198.7	Firm to V. Stiff										
2.9	Grey Shale Bedrock		4	SS	175/23cm		198				
197.6	Highly Weathered										
4.0	End of Borehole Refusal to Auger										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 5

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 806.0; E 287 112.7 ORIGINATED BY DT & HS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT

DATUM Geodetic DATE 84-01-11, 12 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	WATER CONTENT (%) 10 20 30		GR SA SI CL
201.6 Ground Surface											
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	9		201				
			2	SS	65		200		○		8 27 46 19
			3	SS	107		199				
198.7	Stiff to Hard										
2.9	Grey Shale Bedrock		4	SS	100/15cm		198				
	Highly Weathered Limestone		5	BXL RC	88% REC		197				RQD = 0%
	Shale with randomly interbedded limestone seams 20-85 mm thick		6	BXL RC	64% REC		196				RQD = 0%
	Highly Weathered										
195.3	Unweathered		7	BXL RC	93% REC						RQD = 0%
6.3	End of Borehole										

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 6

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 804.7; E 287 098.0 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-11 CHECKED BY GP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.6	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	12		201		○		6 19 53 22
			2	SS	62	▼	200				
			3	SS	69		199				
198.7	Stiff to Hard										
2.9	Grey Shale Bedrock		4	SS	100/10 cm		198				
197.5	Highly Weathered										
4.1	End of Borehole Refusal to Auger										

OFFICE REPORT ON SOIL EXPLORATION

+[3], ×[5] : Numbers refer to Sensitivity

15 20/10 S (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 7

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 776.0; E 287 128.0 ORIGINATED BY DT & HS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT

DATUM Geodetic DATE 84-01-12 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT Wl; WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
201.7 0.0	Ground Surface										
	Heterogenous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	24		201				
			2	SS	40	▼	200		○		23 23 38 16
			3	SS	45		199				
			4	SS	56						
197.9 3.8	V. Stiff to Hard						198				
	Grey Shale Bedrock		5	SS	102/13cm						
							197				
							196				
							195				
							194				
							193				
	Highly Weathered		6	BXL	75%						RQD = 0%
	Shale with randomly interbedded limestone seams 5-130 mm thick						192				
			7	BXL RC	93% REC						RQD = 83%
190.6 11.1	Unweathered						191				
	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 790.0; E 287 128.0 ORIGINATED BY LP
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-13 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.1	Ground Surface						201				
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	34	*	200		o		16 24 44 16
			2	SS	48		199				
			3	SS	83		198				
197.9	Hard										
3.2	Grey Shale Bedrock		4	SS	100/3cm		197				
	Highly Weathered		5	SS	100/13cm		196				
							195				
193.8							194				
7.3	End of Borehole Refusal to Auger										

*Note: Groundwater level not Observed

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 9 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 805.6; E 287 143.7 ORIGINATED BY LP
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-13, 16 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
201.0 0.0	Ground Surface										
	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	26	▼	200				
			2	SS	42		199		o —		3 26 51 20
198.4 2.6	Hard		3	SS	91						
	Grey Shale Bedrock		4	SS	65/3cm		198				
							197				
							196				
							195				
	Weathered						194				
	Shale randomly interbedded with limestone seams 5-50 mm thick		5	BXL RC	46% REC						RQD = 38%
			6	BXL RC	60% REC		193				RQD = 47%
			7	BXL RC	75% REC		192				RQD = 55%
191.5 9.5	Unweathered										
	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

15 20/10 5 (%) STRAIN AT FAILURE

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Ontario

RECORD OF BOREHOLE No 10

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 812.5; E 287 150.6 ORIGINATED BY LP
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-13 CHECKED BY GP

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.9	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	8	*	200				4 20 53 23
			2	SS	37		199				
			3	SS	64		198				
198.0	Stiff to Hard										
2.9	Grey Shale Bedrock		4	SS	75/10cm						
			5	SS	105/13cm		197				
	Weathered		6	SS	100/10cm		196				
							195				
193.5							194				
7.4	End of Borehole Refusal to Auger										
	*Note: Water level not observed										

$+^3$, $\times^5$: Numbers refer to Sensitivity

$\overset{20}{15 \diamond 5}$ (%) STRAIN AT FAILURE
10

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RECORD OF BOREHOLE No 11 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 823.3; E 287 161.8 ORIGINATED BY HS
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-16 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.8	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	10	*	200				
198.9	Stiff to V. Stiff		2	SS	19		199				10 4 54 32
1.9	Grey Shale Bedrock		3	SS	100	3cm	198				
			4	SS	100	10cm					
	Weathered Limestone		5	BXL RC	55% REC		197				RQD = 21%
	shale with randomly interbedded limestone seams 20mm thick Highly weathered		6	BXL RC	68% REC		196				RQD = 0%
194.4	Unweathered		7	BXL RC	65% REC		195				RQD = 42%
6.4	End of Borehole										

*Note: Groundwater level not observed

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 12 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 838.0; E 287 177.0 ORIGINATED BY HS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT

DATUM Geodetic DATE 84-01-16 CHECKED BY GP.

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, x LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.9	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	28	▼	200		o		6 26 49 19
			2	SS	47		199				
198.8	V. Stiff to Hard										
2.1	Grey Shale Bedrock		3	SS	100/10cm		198				
197.7	Weathered										
3.2	End of Borehole Refusal to Auger										

+3, x5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No 13 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 815.5; E 287 198.3 ORIGINATED BY DT

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT

DATUM Geodetic DATE 84-01-17, 18 CHECKED BY GP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.4	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	13	*	200				
			2	SS	44		199				
			3	SS	100/13cm		198				
197.7	Stiff to Hard										
2.7	Grey Shale Bedrock						197				
	Weathered shale with randomly interbedded limestone seams 10-40 mm thick		4	BXL RC	85% REC		196				RQD = 22%
			5	BXL RC	98% REC		195				RQD = 88%
192.8	Unweathered						194				
7.6	End of Borehole						193				

*Note: Groundwater level not observed

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 (%) STRAIN AT FAILURE / 10

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RECORD OF BOREHOLE No 14

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 794.5; E 287 218.8 ORIGINATED BY HS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT

DATUM Geodetic DATE 84-01-16 CHECKED BY GP.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
199.9 0.0	Ground Surface										
	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	18		199				
			2	SS	56/20cm		198				4 15 56 25
197.8 2.1	Stiff to Hard Grey Shale Bedrock		3	SS	95/15cm		197				
			4	SS	120						
			5	SS	100/5cm		196				
	Weathered		6	SS	100/13cm		195				
194.4 5.5	End of Borehole Refusal to Auger										

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+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No 15 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 773.2; E 287 239.6 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-17, 18 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.8	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	42	*	199				
			2	SS	86		198				8 28 45 19
197.4	Hard		3	SS	100/8cm						
2.4	Grey Shale Bedrock		4	BXL RC	14% REC		197				RQD = 0%
	Weathered shale with randomly interbedded limestone seams 10-400 mm thick		5	BXL RC	90% REC		196				RQD = 72%
			6	BXL RC	59% REC		195				RQD = 15%
193.1			7	BXL RC	90% REC		194				RQD = 52%
6.7	End of Borehole										

*Note: Groundwater level not observed

+3, ×5 ; Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 16

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 752.7; E 287 260.0 ORIGINATED BY HS
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-16 CHECKED BY GR

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.5	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)					*	199				
			1	SS	49				W		8 23 52 17
197.5	Hard		2	SS	63		198				
2.0 197.2	Grey Shale Bedrock Weathered										
2.3	End of Borehole Refusal to Auger *Note: Water level not observed										

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, $\times^5$: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 17 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 730.5; E 287 281.5 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-18, 19 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.4	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till		1	SS	38	*	199				
			2	SS	53		198				7 26 51 16
			3	SS	146		197				
196.5 2.9	Hard Grey Shale Bedrock		4	SS	100/13cm		196				
	Weathered limestone shale with randomly interbedded limestone seams 10-200 mm thick		5	BXL RC	83% REC		194				RQD = 22%
			6	BXL RC	100% REC		193				RQD = 92%
191.7 7.7	Unweathered End of Borehole						192				

*Note: Groundwater level not observed

$+^3$, $\times^5$: Numbers refer to Sensitivity

$\frac{20}{15}\diamond\frac{}{10}5$ (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 18

METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 712.4; E 287 299.0 ORIGINATED BY HS
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-16 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.4 / 0.0	Ground Surface						199				
	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	16	▽					
			2	SS	30		198		○ —		8 26 50 16
			3	SS	58		197				
			4	SS	100/8cm						
195.9 / 3.5	V. Stiff to Hard						196				
	Grey Shale Bedrock		5	SS	100/5cm						
194.9 / 4.5	Weathered						195				
	End of Borehole Refusal to Auger										

OFFICE REPORT ON SOIL EXPLORATION

$\bullet^3$, $\times^5$: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
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RECORD OF BOREHOLE No 19 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 691.0; E 287 319.5 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-19 CHECKED BY GP

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100)	PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ O.M.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.3	Ground Surface										
0.0	Silty Clay, some sand, trace to with gravel, trace organics (Fill)		1	SS	15	▼	199		○		32 16 38 14
			2	SS	2		198		○	5.4	4 10 54 32
196.6	V. Soft to Stiff		2A	TW	PH		197	>100			12 25 50 13
2.7	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		3	SS	76		196		○		9 24 52 15
195.3	Hard		4	SS	100/3cm				○		21 18 51 10
4.0	Grey Shale Bedrock		5	SS	103/15cm		195				
	Weathered shale randomly interbedded with limestone seams 20-130 mm thick		6	BX1 RC	58% REC		194				RQD = 33%
			7	BXL RC	94% REC		193				RQD = 18%
			8	BXL RC	95% REC		192				RQD = 12%
	Weathered		9	BXL RC	97% REC		191				RQD = 45%
190.4	Unweathered										
8.9	End of Borehole										

*O.M. - Organic matter

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 20 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 670.2; E 287 341.0 ORIGINATED BY HS
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT
DATUM Geodetic DATE 84-01-16 CHECKED BY GP.

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT W_p / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ O.M.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.4	Ground Surface										
0.0	Silty Clay, Some Sand, Trace to with gravel, Trace Organics (Fill)		1	SS	3		199		○		39 10 41 10
			2	SS	8		198		○	3.6	1 16 59 24
197.3	Soft to Firm										
2.1	Heterogeneous Mixture Silty Clay Trace to Some Sand Gravel (Glacial Till)		3	SS	33		197		○		8 27 50 15
			4	SS	71		196				
			5	SS	72		195		○		19 10 60 11
195.0	Hard										
4.4	Grey Shale Bedrock		6	SS	95/15cm		194				
193.5	Weathered										
5.9	End of Borehole Refusal to Auger										

*O.M. - Organic matter

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, $\times^5$: Numbers refer to Sensitivity

$\frac{20}{15}\diamond\frac{}{5}$ (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
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RECORD OF BOREHOLE No 21 METRIC

W P 21-79-16 LOCATION Co-ords. N 4 838 659.7; E 287 358.3 ORIGINATED BY DT
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT
DATUM Geodetic DATE 84-01-19, 20 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.3	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	29		199		○ —		5 15 47 33
			2	SS	34	▽	198				
			3	SS	27		197		○ —		6 28 51 15
			4	SS	34		196				
195.0	V. Stiff to Hard		5	SS	26		195				
4.3	Grey Shale Bedrock		6	SS	100/3cm						
	Weathered Shale randomly interbedded with limestone seams 20-110 mm thick		7	BXL RC	90% REC		194				RQD = 23%
192.6	Weathered						193				
6.7	End of Borehole										

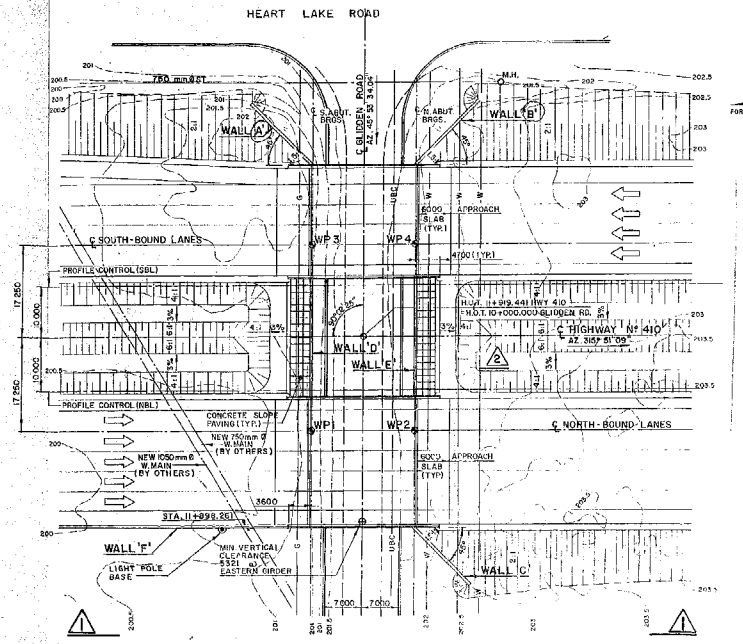
OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

15 ◇ 5 (%) STRAIN AT FAILURE (20 / 10)

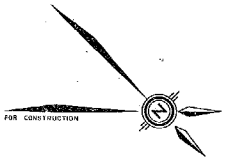
OVERSIZE DRAWING

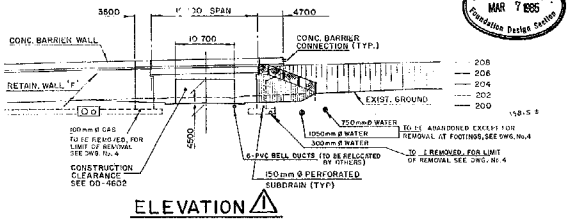
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO — 139-BR-154 01-05



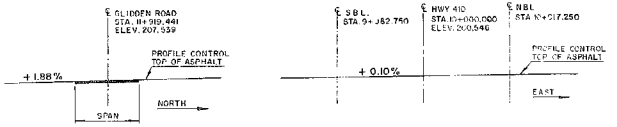
PLAN
1:400

W.P.	STATION	ELEV. T/A
1	11 + 909.579	207.499
2	11 + 929.279	207.869
3	11 + 909.603	207.499
4	11 + 929.303	207.869



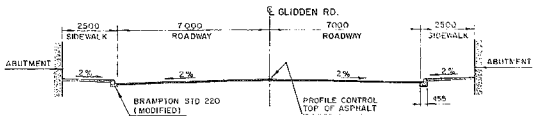


ELEVATION
1:400

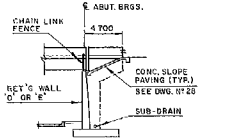


PROFILE OF HWY 410
NTS

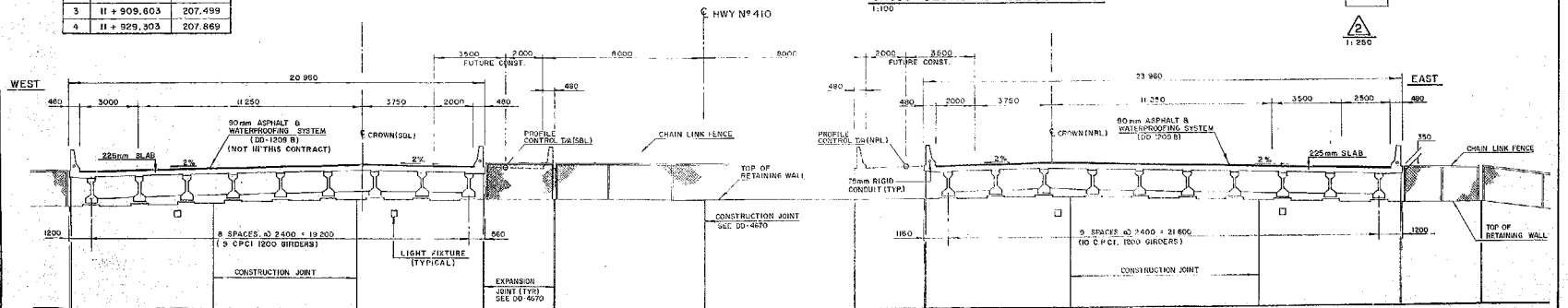
PROFILE OF GLIDDEN ROAD
NTS



CROSS-SECTION OF GLIDDEN ROAD
1:100



2
1:250



TYPICAL DECK CROSS-SECTION
1:100

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

A.S. WILKINS — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO
P. FURST — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

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DIST. No 6
CONT No
WP No 21-79-16

HWY 410 OVERPASS AT GLIDDEN ROAD
GENERAL ARRANGEMENT I

SHEET 132

WYLLIE & UFNAL LIMITED
CONSULTING PROFESSIONAL ENGINEERS

GENERAL NOTES:

1. CLASS OF CONCRETE

FOOTINGS AND SLOPE PAVING	20 MPa
ABUTMENTS, WINGWALLS, RETAINING WALLS, DECK, BARRIER WALLS, AND APPROACH SLABS	30 MPa
PRESTRESSED GIRDERS	40 MPa

2. REINFORCING STEEL.
GRADE 400
BAR MARK WITH SUFFIX 'C' DENOTES COATED BAR

3. CLEAR COVER TO REINFORCING STEEL.

FOOTINGS	100 ± 25
DECK TOP	70 ± 20
DECK BOTTOM	40 ± 10
FRONT FACE OF ABUTMENTS AND RETAINING WALLS	80 ± 20
PRESTRESSED GIRDERS	30 ± 5
REMAINDER	70 ± 20

4. CONSTRUCTION NOTES.

- THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 3mm.
- APPROACH SLABS AND ASPHALT WATERPROOFING SYSTEM FOR THE S.B.L. STRUCTURE ARE NOT PART OF THIS CONTRACT.
- CONC. BARRIER WALLS ON RETAINING WALL 'F' SHALL NOT BE CAST UNTIL THE RETAINING WALL BACKFILL HAS BEEN COMPLETED

LIST OF DRAWINGS
SEE DRAWING No. 2

REVISIONS		
DATE	BY	DESCRIPTION
DESIGN ASW	CHECK PF	LOADING CHBDC A-83
DRAWING GS	CHECK PF	SITE 54-HIS-407

DATE JUNE '94
DWG 1

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO CM-BR 1314 01-86

FOR CONSTRUCTION

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P. FURST — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

METRIC

DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

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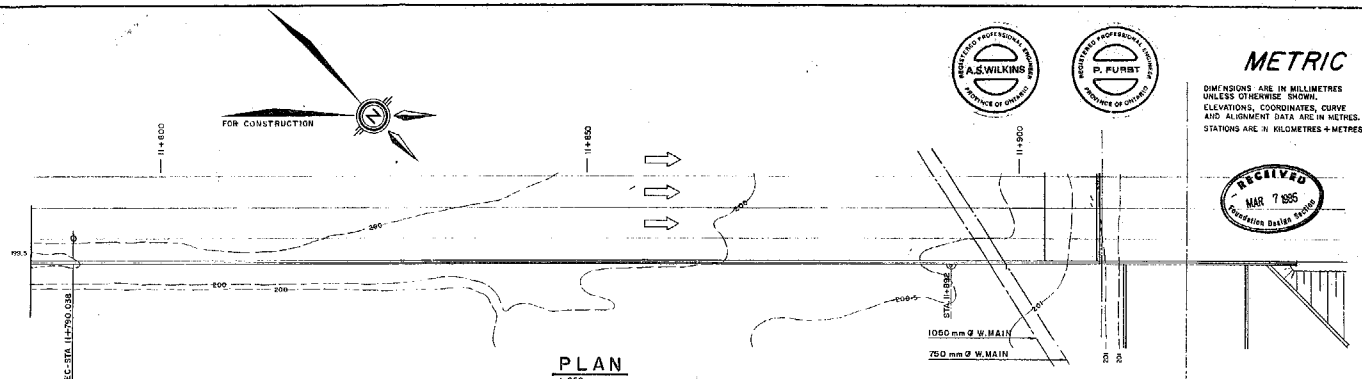
DIST No 6
CONT No
WP No 21-79-27

HWY 410 OVERPASS AT GLIDDEN ROAD
GENERAL ARRANGEMENT II

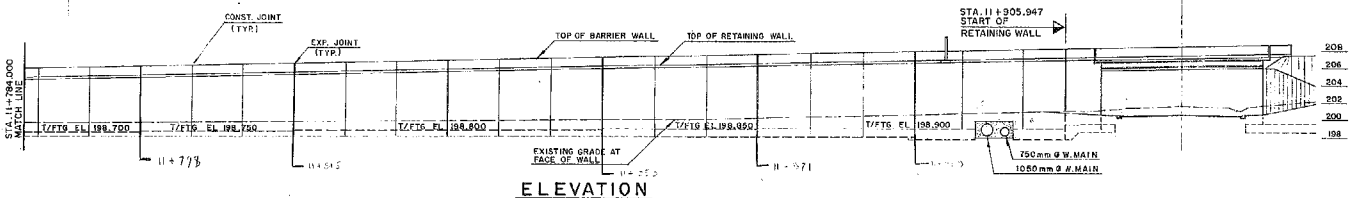
SHEET 13

WYLLIE & UFNAL LIMITED
CONSULTING PROFESSIONAL ENGINEERS

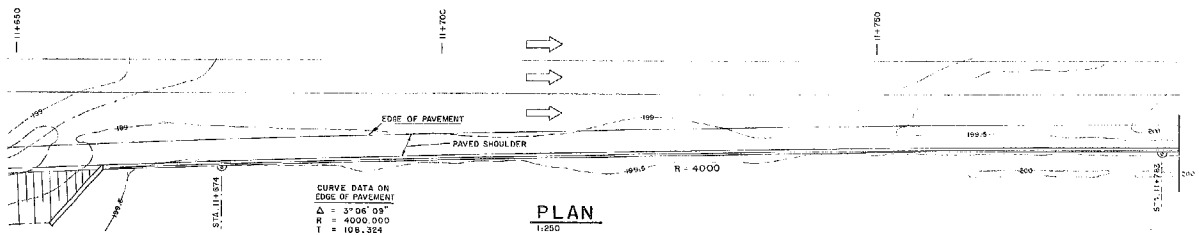
LIST OF DRAWINGS



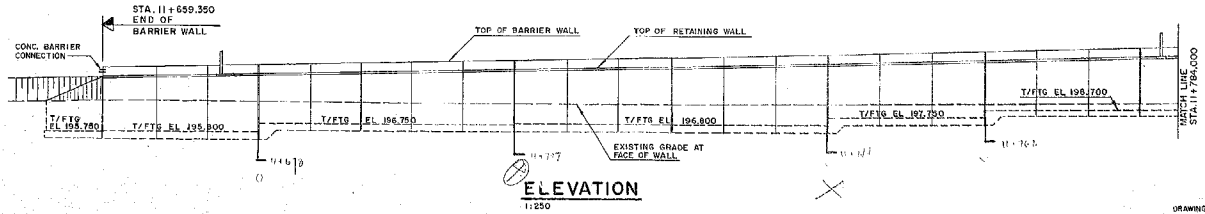
PLAN
1:250



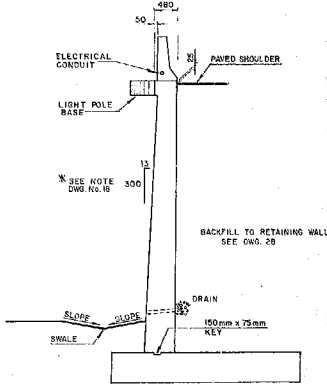
ELEVATION
1:250



PLAN
1:250



ELEVATION
1:250



TYPICAL SECTION

1:50 EXCEPT WHERE NOTED

NOTE:
FOR GENERAL NOTES SEE GENERAL ARRANGEMENT I

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN ASW	CHECK PF	LOADING ONHDO CL-625	DATE JUNE '94
DRAWING GS	CHECK PF	SITE 24-105-487	DWG 2